

PATENT COOPERATION TREATY

PCT

From the INTERNATIONAL BUREAU

NOTIFICATION OF THE RECORDING
OF A CHANGE(PCT Rule 92bis.1 and
Administrative Instructions, Section 422)

To:

BUDZYN, Ludomir, A.
Hoffmann & Baron, LLP
6900 Jericho Turnpike
Syosset, New York 11791
ETATS-UNIS D'AMERIQUE

38
52

90

Date of mailing (day/month/year) 16 August 2001 (16.08.01)	IMPORTANT NOTIFICATION
Applicant's or agent's file reference 453321/004	
International application No. PCT/US00/23206	International filing date (day/month/year) 23 August 2000 (23.08.00)

1. The following indications appeared on record concerning:									
<input type="checkbox"/> the applicant	<input type="checkbox"/> the inventor								
<input checked="" type="checkbox"/> the agent	<input type="checkbox"/> the common representative								
Name and Address BUDZYN, Ludomir, A. Stroock & Stroock & Lavan LLP 180 Maiden Lane New York, NY 10038-4925 United States of America	<table border="1"> <tr> <td>State of Nationality</td> <td>State of Residence</td> </tr> <tr> <td colspan="2">Telephone No. 212 806 5400</td> </tr> <tr> <td colspan="2">Facsimile No. 212 806 6006</td> </tr> <tr> <td colspan="2">Teleprinter No.</td> </tr> </table>	State of Nationality	State of Residence	Telephone No. 212 806 5400		Facsimile No. 212 806 6006		Teleprinter No.	
State of Nationality	State of Residence								
Telephone No. 212 806 5400									
Facsimile No. 212 806 6006									
Teleprinter No.									
2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:									
<input type="checkbox"/> the person	<input type="checkbox"/> the name								
<input checked="" type="checkbox"/> the address	<input type="checkbox"/> the nationality								
<input type="checkbox"/> the residence									
Name and Address BUDZYN, Ludomir, A. Hoffmann & Baron, LLP 6900 Jericho Turnpike Syosset, New York 11791 United States of America	<table border="1"> <tr> <td>State of Nationality</td> <td>State of Residence</td> </tr> <tr> <td colspan="2">Telephone No. 973 331 1700</td> </tr> <tr> <td colspan="2">Facsimile No. 973 331 1717</td> </tr> <tr> <td colspan="2">Teleprinter No.</td> </tr> </table>	State of Nationality	State of Residence	Telephone No. 973 331 1700		Facsimile No. 973 331 1717		Teleprinter No.	
State of Nationality	State of Residence								
Telephone No. 973 331 1700									
Facsimile No. 973 331 1717									
Teleprinter No.									
3. Further observations, if necessary:									
4. A copy of this notification has been sent to:									
<input checked="" type="checkbox"/> the receiving Office	<input checked="" type="checkbox"/> the designated Offices concerned								
<input type="checkbox"/> the International Searching Authority	<input type="checkbox"/> the elected Offices concerned								
<input type="checkbox"/> the International Preliminary Examining Authority	<input type="checkbox"/> other:								

<p>The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland</p> <p>Facsimile No.: (41-22) 740.14.35</p>	<p>Authorized officer</p> <p>David Lopez-Ramirez</p> <p>Telephone No.: (41-22) 338.83.38</p>
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PATENT COOPERATION TRF Y

PCT

COMMUNICATION IN CASES FOR WHICH
NO OTHER FORM IS APPLICABLE

From the INTERNATIONAL BUREAU

To:

BUDZYN, Ludomir, A.
Stroock & Stroock & Lavan LLP
180 Maiden Lane
New York, NY 10038-4925
ETATS-UNIS D'AMERIQUE

Date of mailing (<i>day/month/year</i>) 08 January 2001 (08.01.01)	
Applicant's or agent's file reference 453321/004	REPLY DUE see paragraph 1 below
International application No. PCT/US00/23206	International filing date (<i>day/month/year</i>) 23 August 2000 (23.08.00)
Applicant COHEN, Ben, Z.	

1. ☐ REPLY DUE within _____ months/days from the above date of mailing
- ☐ NO REPLY DUE, however, see below
- ☒ IMPORTANT COMMUNICATION
- ☐ INFORMATION ONLY

2. COMMUNICATION:

The International Bureau has been informed by the receiving Office (RO/US) on 21 December 2000 (21.12.00) that the international filing date has been corrected to read 23 August 2000 (23.08.00) instead of 25 August 2000 (25.08.00).

A copy of this notification has been sent to the receiving Office and the designated Offices concerned.

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland	Authorized officer Beatriz Morariu
Facsimile No. (41-22) 740.14.35	Telephone No. (41-22) 338.83.38

PATENT COOPERATION TREATY

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Commissioner
 US Department of Commerce
 United States Patent and Trademark
 Office, PCT
 2011 South Clark Place Room
 CP2/5C24
 Arlington, VA 22202
 ETATS-UNIS D'AMERIQUE
 in its capacity as elected Office

Date of mailing (day/month/year) 13 December 2001 (13.12.01)	
International application No. PCT/US00/23206	Applicant's or agent's file reference 453321/004
International filing date (day/month/year) 23 August 2000 (23.08.00)	Priority date (day/month/year) 23 August 1999 (23.08.99)
Applicant COHEN, Ben, Z. et al	

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:
 23 March 2001 (23.03.01)

☐ in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was
☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland	Authorized officer ENGER Charlotte
Facsimile No.: (41-22) 740.14.35	Telephone No.: (41-22) 338.83.38

PATENT COOPERATION TREATY

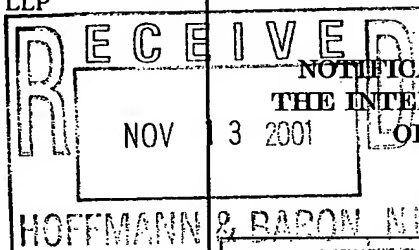
1181-3 PCT
1181-0005

From the INTERNATIONAL SEARCHING AUTHORITY

To: LUDOMIR A. BUDZYN
STROOCK & STROOCK & LAVAN LLP
180 MAIDEN LANE
NEW YORK, NY 10038-4925

PCT

Docket

NOTIFICATION OF TRANSMITTAL OF
THE INTERNATIONAL SEARCH REPORT
OR THE DECLARATION

(PCT Rule 44.1)

Date of Mailing
(day/month/year)

09 OCT 2001

Applicant's or agent's file reference

453321/004

FOR FURTHER ACTION See paragraphs 1 and 4 below

International application No.

PCT/US00/23206

International filing date

(day/month/year)

23 AUGUST 2000

Applicant

COHEN, BEN Z.

1. ☐ The applicant is hereby notified that the international search report has been established and is transmitted herewith.

Filing of amendments and statement under Article 19:

The applicant is entitled, if he so wishes, to amend the claims of the international application (see Rule 46):

When? The time limit for filing such amendments is normally 2 months from the date of transmittal of the international search report; however, for more details, see the notes on the accompanying sheet.

Where? Directly to the International Bureau of WIPO

34, chemin des Colombettes
1211 Geneva 20, Switzerland
Facsimile No.: (+1-22) 740.14.35

For more detailed instructions, see the notes on the accompanying sheet.

2. ☐ The applicant is hereby notified that no international search report will be established and that the declaration under Article 17(2)(a) to that effect is transmitted herewith.

3. ☒ With regard to the protest against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:

☒ the protest together with the decision thereon has been transmitted to the International Bureau together with the applicant's request to forward the texts of both the protest and the decision thereon to the designated Offices.

☐ no decision has been made yet on the protest; the applicant will be notified as soon as a decision is made.

4. **Further action(s):** The applicant is reminded of the following:

Shortly after 18 months from the priority date, the international application will be published by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau as provided in rules 90 bis 1 and 90 bis 3, respectively, before the completion of the technical preparations for international publication.

Within 19 months from the priority date, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase until 30 months from the priority date (in some Offices even later).

Within 20 months from the priority date, the applicant must perform the prescribed acts for entry into the national phase before all designated Offices which have not been elected in the demand or in a later election within 19 months from the priority date or could not be elected because they are not bound by Chapter II.

Name and mailing address of the ISA/US

Commissioner of Patents and Trademarks
Box PCT
Washington, D.C. 20231

Facsimile No. (703) 305-3230

Authorized officer

KENNETH BOMBERG

Telephone No. (703) 308-2179

JM
B?
453321/004

PATENT COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTHORITY

To: LUDOMIR A. BUDZYN
STROOCK & STROOCK & LAVAN LLP
180 MAIDEN LANE
NEW YORK, NY 10038-4925

PCT

NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL SEARCH REPORT OR THE DECLARATION

(PCT Rule 44.1)

Applicant's or agent's file reference 453321/004	Date of Mailing (day/month/year) 05 OCT 2001
International application No. PCT/US00/23206	International filing date (day/month/year) 23 AUGUST 2000
Applicant COHEN, BEN Z.	

1. ☐ The applicant is hereby notified that the international search report has been established and is transmitted herewith.

Filing of amendments and statement under Article 19:
 The applicant is entitled, if he so wishes, to amend the claims of the international application (see Rule 46):

When? The time limit for filing such amendments is normally 2 months from the date of transmittal of the international search report; however, for more details, see the notes on the accompanying sheet.

Where? Directly to the International Bureau of WIPO
 34, chemin des Colombettes
 1211 Geneva 20, Switzerland
 Facsimile No.: (41-22) 740.14.35

For more detailed instructions, see the notes on the accompanying sheet.

2. ☐ The applicant is hereby notified that no international search report will be established and that the declaration under Article 17(2)(a) to that effect is transmitted herewith.

3. ☒ With regard to the protest against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:

☒ the protest together with the decision thereon has been transmitted to the International Bureau together with the applicant's request to forward the texts of both the protest and the decision thereon to the designated Offices.

☐ no decision has been made yet on the protest; the applicant will be notified as soon as a decision is made.

4. **Further action(s):** The applicant is reminded of the following:

Shortly after 18 months from the priority date, the international application will be published by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau as provided in rules 90 bis 1 and 90 bis 3, respectively, before the completion of the technical preparations for international publication.

Within 19 months from the priority date, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase until 30 months from the priority date (in some Offices even later).

Within 20 months from the priority date, the applicant must perform the prescribed acts for entry into the national phase before all designated Offices which have not been elected in the demand or in a later election within 19 months from the priority date or could not be elected because they are not bound by Chapter II.

Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box POT Washington, D.C. 20231	Authorized officer <i>J. Hurley for</i> KENNETH BOMBERG
Facsimile No. (703) 305-9230	Telephone No. (703) 308-2179

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference 453321/004	FOR FURTHER ACTION <small>see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.</small>	
International application No. PCT/US00/23206	International filing date (day/month/year) 23 AUGUST 2000	(Earliest) Priority Date (day/month/year) 23 AUGUST 1999
Applicant COHEN, BEN Z.		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 6 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

a. With regard to the language, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

b. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international search was carried out on the basis of the sequence listing:

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the

☐ the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

2. ☒ Certain claims were found unsearchable (See Box I).

3. ☒ Unity of invention is lacking (See Box II).

4. With regard to the title,

☒ the text is approved as submitted by the applicant.

☐ the text has been established by this Authority to read as follows:

5. With regard to the abstract,

☐ the text is approved as submitted by the applicant.

☒ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the drawings to be published with the abstract is Figure No. 1

☒ as suggested by the applicant.

☐ because the applicant failed to suggest a figure.

☐ because this figure better characterizes the invention.

☐ None of the figures.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US00/23206

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This international report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☒ Claims Nos.: 9, 42-45, 49-51
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

Please See Extra Sheet.

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

Please See Extra Sheet.

1. ☒ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☒ The additional search fees were accompanied by the applicant's protest.
☐ No protest accompanied the payment of additional search fees.

Box III TEXT OF THE ABSTRACT (Continuation of item 5 of the first sheet)

The technical features mentioned in the abstract do not include a reference sign between parentheses (PCT Rule 8.1(d)).

The abstract is too long (PCT Rule 8.1(b)). The abstract must be less than 150 words, or 200 words when no Figure is to be published.

Abstract

A pre-compression pump (10) dispenses microdoses of fluid (F). The pump minimizes pulsing due to pressure fluctuations. The pump is provided with the following to limit pulsing: a low force slow return velocity return spring (46); enlarged fluid passage (58); elastic bumper (74); and, a ratchet tooth (76) bearing against the stem (44). Further, a deflectable diaphragm (90), a splined (70) stem (44), no dip tube, and an off-center, gravitational low-point pump inlet (62) assist in priming the pump. The pump includes a stem (44) with deflectable fingers (92) to ensure sufficient momentum in pump operation. Detents (118) and grooves (120) selectively lock a nozzle cap (14) in an inoperative position. To ensure cleanliness, nozzle (60) cleaning is provided, wiping of the nozzle to remove meniscus (M) therefrom, cuts (104) formed in a shroud (98) assist in drawing excess fluid from the nozzle, and an empty volume (108) for collecting fluid run-off from the nozzle. A handle (H) is mounted to the pump providing a grip.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US00/23206

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) :B67D 5/33, 5/42

US CL :222/153.13, 148, 321.2, 321.5, 321.9, 382

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 222/108, 153.13, 148, 321.1, 321.2, 321.3, 321.5, 321.7, 321.9, 382, 402.12

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 3,352,463 A (BERLER) 14 NOVEMBER 1967, col. 2, line 10 to col. 5, line 10.	1-5, 53
X	US 5,806,721 A (TADA) 15 SEPTEMBER 1998, col. 4, line 9 to col. 9, line 2.	1-4, 6, 53
X	US 5,381,932 A (HUMPHREY) 17 JANUARY 1995, col. 2, line 44 to col. 3, line 61.	1-4, 6-7, 53
A	US 5,062,549 A (SMITH et al.) 05 NOVEMBER 1991, Fig. 3.	NONE
A, T, E	US 6,126,038 A (OLEGNOWICZ) 03 OCTOBER 2000, Fig. 1.	NONE
X	US 3,949,906 A (PETTERSEN et al.) 13 April 1976, col. 3, line 9 to col. 6, line 30.	18-24, 27-30; 53



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E" earlier document published on or after the international filing date	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&" document member of the same patent family
"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search 08 OCTOBER 2001	Date of mailing of the international search report
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230	Authorized officer <i>A. Hurley for</i> KENNETH BOMBERG Telephone No. (703) 308-2179

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US00/23206

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5,850,948 A (GARCIA et al.) 22 December 1998, col. 4, lines 46-57.	25-26, 53
X	US 5,918,774 A (LUND et al.) 06 July 1999, col. 2, line 55 to col. 4, line 65.	35-36, 41, 46-48, 52-53

BOX I. OBSERVATIONS WHERE CLAIMS WERE FOUND UNSEARCHABLE

2. Where no meaningful search could be carried out, specifically:

The drawings omit reference numbers corresponding to the specification and are of poor quality. The poor quality and omitted reference numbers in the drawings made understanding and interpretation of the claims in view of the specification difficult. In the case of these listed claims, no meaningful search could be carried out.

BOX II. OBSERVATIONS WHERE UNITY OF INVENTION WAS LACKING

This ISA found multiple inventions as follows:

This application contains the following inventions or groups of inventions which are not so linked as to form a single inventive concept under PCT Rule 13.1. In order for all inventions to be searched, the appropriate additional search fees must be paid.

Group I, claim(s) 1-10 & 53, drawn to a pump including an inlet in communication with a reservoir.

Group II, claim(s) 11-17 & 53, drawn to a pump with a plurality of cantilevered fingers and a pin.

Group III, claim(s) 18-21 & 53, drawn to a pump with a seal mounted to a stem.

Group IV, claim(s) 22-24 & 53, drawn to a pump including a spring urging a stem toward a piston.

Group V, claim(s) 25-26 & 53, drawn to a pump with a passage with an enlarged cross section portion.

Group VI, claim(s) 27-30 & 53, drawn to a pump with a bumper between a stem and a nozzle.

Group VII, claim(s) 31-34 & 53, drawn to a pump including a ratchet tooth on a piston bearing against a stem.

Group VIII, claim(s) 35-36 & 53, drawn to a pump with a shroud with an opening registering with a and wiping a nozzle.

Group IX, claim(s) 37-40 & 53, drawn to a pump with a shroud with a plurality of cuts.

Group X, claim(s) 41-45, drawn to a pump including a shroud encompassing a void.

Group XI, claim(s) 46-48 & 53, drawn to a pump with a shroud having a relatively rotatable nozzle.

Group XII, claim(s) 49-50 & 53, drawn to a pump with a tubular handle.

Group XIII, claim(s) 51 & 53, drawn to a pump with a deflectable diaphragm.

Group XIV, claim(s) 52 & 53, drawn to a pump with nozzle cap formed with a radially extending seal member.

The inventions listed as Groups I-XIV do not relate to a single inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons: In each of the Groups listed above, the identified special technical feature has been omitted from the independent claims of each of the other Groups listed above.

REVISED VERSION

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
1 March 2001 (01.03.2001)

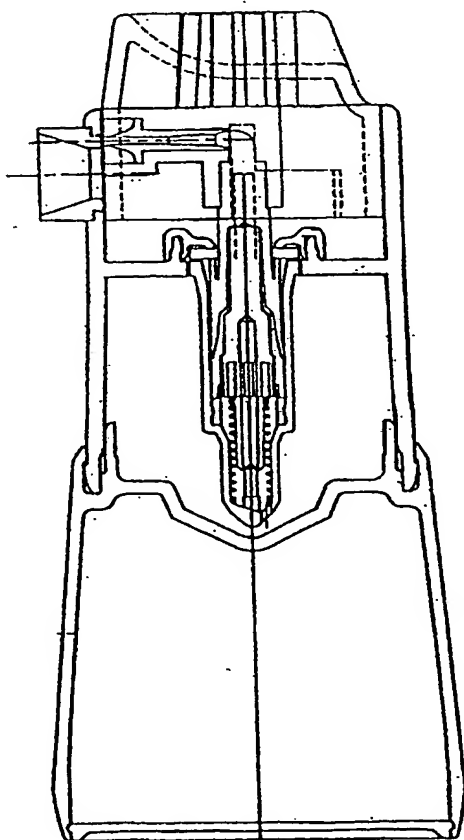
PCT

(10) International Publication Number
WO 01/14245 A1

- (51) International Patent Classification⁷: **B67D 5/42** (72) Inventor; and
(21) International Application Number: **PCT/US00/23206** (75) Inventor/Applicant (for US only): **KELLY, Nigel**
[GB/US]; 60 Fulton Avenue, Rye, NY 10580 (US).
(22) International Filing Date: **23 August 2000 (23.08.2000)** (74) Agent: **BUDZYN, Ludomir, A.**; Hoffmann & Baron,
LLP, 6900 Jericho Turnpike, Syosset, New York 11791
(25) Filing Language: **English** (US).
(26) Publication Language: **English** (81) Designated States (national): **AE, AG, AL, AM, AT, AU,**
AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ,
DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR,
HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR,
LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ,
NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM,
TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.
(30) Priority Data:
60/150,405 23 August 1999 (23.08.1999) **US**
(71) Applicant and
(72) Inventor: **COHEN, Ben, Z.** [US/US]; 140 East 80th
Street, New York, NY 10021 (US).

[Continued on next page]

(54) Title: **MICRODISPENSING PUMP**



(57) Abstract: A pre-compression pump (10) dispenses microdoses of fluid (F). The pump minimizes pulsing due to pressure fluctuations. The pump is provided with the following to limit pulsing: a low force slow return velocity return spring (46); enlarged fluid passage (58); elastic bumper (74); and, a ratchet tooth (76) bearing against the stem (44). Further, a deflectable diaphragm (90), a splined (70) stem (44), no dip tube, and an off-center, gravitational low-point pump inlet (62) assist in priming the pump. The pump includes a stem (44) with deflectable fingers (92) to ensure sufficient momentum in pump operation. Detents (118) and grooves (120) selectively lock a nozzle cap (14) in an inoperative position. To ensure cleanliness, nozzle (60) cleaning is provided, wiping of the nozzle to remove meniscus (M) therefrom, cuts (104) formed in a shroud (98) assist in drawing excess fluid from the nozzle, and an empty volume (108) for collecting fluid run-off from the nozzle. A handle (H) is mounted to the pump providing a grip.

WO 01/14245 A1



(84) Designated States (regional): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:

— with international search report

(88) Date of publication of the revised international search report: 28 February 2002

(15) Information about Correction:
see PCT Gazette No. 09/2002 of 28 February 2002, Section II

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

REVISED
VERSION

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US00/23206

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) :B67D 5/33, 5/42

US CL :222/153.13, 148, 321.2, 321.5, 321.9, 382

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 222/108, 153.13, 148, 321.1, 321.2, 321.3, 321.5, 321.7, 321.9, 382, 402.12

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 3,352,463 A (BERLER) 14 NOVEMBER 1967, col. 2, line 10 to col. 5, line 10.	1-5, 53
X	US 5,806,721 A (TADA) 15 SEPTEMBER 1998, col. 4, line 9 to col. 9, line 2.	1-4, 6, 53
X	US 5,381,932 A (HUMPHREY) 17 JANUARY 1995, col. 2, line 44 to col. 3, line 61.	1-4, 6-7, 53
A	US 5,062,549 A (SMITH et al.) 05 NOVEMBER 1991, Fig. 3.	NONE
A, T, E	US 6,126,038 A (OLEGNOWICZ) 03 OCTOBER 2000, Fig. 1.	NONE
X	US 3,949,906 A (PETTERSEN et al.) 13 April 1976, col. 3, line 9 to col. 6, line 30.	18-24, 27-30, 53



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E" earlier document published on or after the international filing date	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&" document member of the same patent family
"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search

08 OCTOBER 2001

Date of mailing of the international search report

28 NOV 2001

Name and mailing address of the ISA/US
Commissioner of Patents and Trademarks
Box PCT
Washington, D.C. 20231

Facsimile No. (703) 305-3230

Authorized officer

KENNETH BOMBERG

Telephone No. (703) 308-2179

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US00/23206

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5,850,948 A (GARCIA et al.) 22 December 1998, col. 4, lines 46-57.	25-26, 53
X	US 5,918,774 A (LUND et al.) 06 July 1999, col. 2, line 55 to col. 4, line 65.	35-36, 41, 46-48, 52-53

INTERNATIONAL SEARCH REPORT

1. International application No.
PCT/US00/23206

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This international report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☒ Claims Nos.: 9, 42-45, 49-51
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

Please See Extra Sheet.
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

Please See Extra Sheet.

1. ☒ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☒ The additional search fees were accompanied by the applicant's protest.
☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US00/23206

BOX I. OBSERVATIONS WHERE CLAIMS WERE FOUND UNSEARCHABLE

2. Where no meaningful search could be carried out, specifically:

The drawings omit reference numbers corresponding to the specification and are of poor quality. The poor quality and omitted reference numbers in the drawings made understanding and interpretation of the claims in view of the specification difficult. In the case of these listed claims, no meaningful search could be carried out.

BOX II. OBSERVATIONS WHERE UNITY OF INVENTION WAS LACKING

This ISA found multiple inventions as follows:

This application contains the following inventions or groups of inventions which are not so linked as to form a single inventive concept under PCT Rule 13.1. In order for all inventions to be searched, the appropriate additional search fees must be paid.

Group I, claim(s) 1-10 & 53, drawn to a pump including an inlet in communication with a reservoir.

Group II, claim(s) 11-17 & 53, drawn to a pump with a plurality of cantilevered fingers and a pin.

Group III, claim(s) 18-21 & 53, drawn to a pump with a seal mounted to a stem.

Group IV, claim(s) 22-24 & 53, drawn to a pump including a spring urging a stem toward a piston.

Group V, claim(s) 25-26 & 53, drawn to a pump with a passage with an enlarged cross section portion.

Group VI, claim(s) 27-30 & 53, drawn to a pump with a bumper between a stem and a nozzle.

Group VII, claim(s) 31-34 & 53, drawn to a pump including a ratchet tooth on a piston bearing against a stem.

Group VIII, claim(s) 35-36 & 53, drawn to a pump with a shroud with an opening registering with a and wiping a nozzle.

Group IX, claim(s) 37-40 & 53, drawn to a pump with a shroud with a plurality of cuts.

Group X, claim(s) 41-45, drawn to a pump including a shroud encompassing a void.

Group XI, claim(s) 46-48 & 53, drawn to a pump with a shroud having a relatively rotatable nozzle.

Group XII, claim(s) 49-50 & 53, drawn to a pump with a tubular handle.

Group XIII, claim(s) 51 & 53, drawn to a pump with a deflectable diaphragm.

Group XIV, claim(s) 52 & 53, drawn to a pump with nozzle cap formed with a radially extending seal member.

The inventions listed as Groups I-XIV do not relate to a single inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons: In each of the Groups listed above, the identified special technical feature has been omitted from the independent claims of each of the other Groups listed above.

MICRODISPENSING PUMP

This application claims priority of U.S. Provisional Patent Application Serial No. 60/150,405, filed August 23, 1999.

This invention relates to pumps for dispensing fluids and medications, and, more particularly, to microdispensing pumps.

In the prior art, positive displacement and pre-compression pumps are known. In addition, U.S. Patent No. 5,881,956, to the inventors herein, discloses a positive displacement pump which is capable of dispensing microdoses of fluid, as small as 5-10 microliters. U.S. Patent No. 5,881,956 is incorporated by reference herein. With such small dosing capability, the pumps of U.S. Patent No. 5,881,956 are advantageously usable to dispense ophthalmic medication. Although some of the teachings of U.S. Patent No. 5,881,956 can be applied to the pre-compression pump art, there are significant differences between the pumps which prevent full carry-over of the technology.

A pre-compression pump operates on the principle that the pressure build-up within a pump cylinder propels a fluid out of the pump. The ejection of the fluid drains the pump cylinder thereby causing a pressure differential which results in additional fluid being drawn into the pump cylinder. In contrast, a positive displacement pump relies on one dose of fluid literally "pushing" out, and thus causing ejection of, a preceding dose of fluid.

As can be appreciated, the consistent dispensing of microdoses (5-10 microliters) of fluid presents a unique set

of problems. The problems of priming pumps with such small doses with positive displacement pumps are addressed in U.S. Patent No. 5,881,956. Because of the difference in operating principles between positive displacement pumps and pre-compression pumps, the disclosure of the aforementioned patent can not be fully applied to pre-compression pumps to achieve microdosing of 5-10 microliters. For example, it has been found that fluids generally pulse upon dispensing from a pre-compression pump because of pressure fluctuations, the pulsing action resulting in atomization of the dispensed fluid. Particularly, pressure fluctuations are generated during pump operation, where a pressure build-up within the cylinder of the pump causes the stem of the pump to separate from the piston, thereby allowing pressurized fluid to rush into, and out of, the nozzle of the pump. However, upon initial separation of the stem from the piston, the pressure within the cylinder quickly decays, with the stem being urged back into sealing contact with the piston by a return spring. The fluid is then quickly re-pressurized in the cylinder, again causing separation of the stem from the piston, thus, achieving further fluid delivery. This repeated "opening" and "closing" of the pump cylinder occurs rapidly with the dose being continuously and interruptedly delivered. The internal pressure of the dose, however, fluctuates as it is dispensed causing the dispensed fluid to pulse.

With typical uses of pre-compression pumps, pulsing does not interfere with the required atomization of the dispensed liquid. Typical doses are relatively large, and, thus, are substantially insensitive to the pressure

fluctuations; pre-compression pumps generally dispense doses much larger than 10 microliters, with such doses being on the order of at least 70 microliters. Where it is desired to consistently dispense microdoses of fluid without atomization, such as with ophthalmic medication, pressure fluctuations have an adverse effect. Furthermore, medication is ideally delivered in a stable, relatively laminar flow pattern, with little pressure fluctuation throughout dosage delivery. Atomization of the fluid is not desired.

Accordingly, it is an object of the subject application to provide a pre-compression pump capable of consistently dispensing repeated microdoses of fluid and medication without atomization.

SUMMARY OF THE INVENTION

The aforementioned object is met by a pre-compression pump having various inventive features. It should be noted that some of the features can be carried over to other pump arts beyond the field of pre-compression pumps, such as lift pumps.

In a first aspect of the invention, the pump includes features to minimize the pulsing effect caused by pressure fluctuations in a pre-compression pump, thereby avoiding atomization in dispensing a fluid. Specifically, the pump is provided with various elements which restrict the responsive movement of the stem so that the stem does not quickly respond to the pressure fluctuations in the pump cylinder. Accordingly, the stem will respond relatively slowly to the decay of internal pressure of the cylinder,

thereby prolonging the uninterrupted delivery of fluid without pulsing and allowing for a laminar delivery. First, a return spring is provided to urge components into a rest position which is formed with a low spring force and/or is wound to have a slow return velocity (typical coil springs are wound to have high return velocities). Accordingly, the spring will react weakly/slowly to pressure decay within the pump cylinder with the stem being urged into a closed position relatively slowly as compared to the rate of pressure decay. Second, portions of the fluid passage communicating the pump cylinder and the nozzle are enlarged so as to reduce restriction to flow, thereby minimizing throttling of the fluid, and to provide a damping effect on the fluid. The reduction in throttling and the damping effect coact to reduce pulsing in the fluid. Third, an elastically-deformable bumper may be disposed on the end of the stem of the pump. The bumper, which may be in the form of a deflectable dome or a solid member, is disposed on an end of the stem so as to absorb, and react to, pressure of the fluid, thereby minimizing the stem's reaction to fluid pressure. Fourth, an internal seal may be formed with a generally triangular cross-section to increase fluid drag on the stem and further inhibit movement of the stem. Fifth, a ratchet tooth may be disposed on the pump piston which bears against the stem and inhibits movement of the stem, thereby also reducing the stem's reaction to fluid pressure.

In addition, in a second aspect of the invention, priming of the pump is a concern, since a relatively minor air pocket will inhibit, or altogether prevent, the ability of the

pump to dispense microdoses. To aid in proper priming, a partially splined stem is preferably used, wherein shallow recesses are formed between the splines. The recesses are sufficiently shallow such that air bubbles may pass between the splines via the recesses, but un-pressurized fluid will not because of its viscosity. As such, air bubbles may escape without hindering operation of the pump. Also no dip tube is utilized, thereby eliminating the possibility of an air pocket being trapped in the dip tube. During priming of a pump with a dip tube, a sufficient amount of fluid must be drawn from the dip tube to ensure no air pockets are therein. Air pockets are compressible and inhibit, or defeat, continuous operation of a pump. Without a dip tube, an inlet is formed in the pump cylinder which is in direct communication with the fluid reservoir of the pump. Preferably, the inlet is located off-center in the pump cylinder and at a low point on a tapered surface. With the off-set location and tapered surface, air bubbles will not become entrapped at the bottom of the cylinder, and the air bubbles will have an unobstructed path up along the outside of the pump cylinder to escape the pump. In addition, a deflectable diaphragm may be provided which is deflectable into the fluid reservoir to reduce the volume thereof.

Furthermore, in a third aspect of the invention, the pump includes a stem formed with deflectable fingers that yield under a pre-determined amount of operational force thereby ensuring sufficient momentum is provided in operating the pump. In this manner, the pump can only be operated with sufficient force to ensure full and proper fluid dispensing.

In a fourth aspect of the invention, cleanliness of the pump is of concern. Cooperative detents and grooves are formed to selectively lock the nozzle cap in an inoperative, locked position. In a locked position, the nozzle of the pump is covered by a shroud which prevents dirt and debris from collecting on the nozzle. The nozzle cap and shroud are preferably formed with cooperating members which overlap in a locked position to form a seal in proximity to the nozzle to further inhibit the ingress of dirt and debris between the shroud and nozzle cap. The pump also provides for cleaning of the nozzle, with an opening in the shroud wiping the nozzle to remove any meniscus therefrom after dispensing fluid. Additionally, cuts are formed in the shroud facing the nozzle cap which assist in drawing excess fluid from the nozzle, and an empty void is located about the nozzle for collecting fluid run-off from the nozzle.

In a fifth aspect of the invention, a handle is also mounted to the pump to provide a comfortable grip for handling the pump.

These and other features of the invention will be better understood through a study of the following detailed description and accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an elevational view of a pump in accordance with the subject invention;

FIG. 1A is a cross-sectional view taken along line 1A-1A of FIG. 1;

FIG. 2 is an enlarged view of the nozzle of the pump;

FIG. 3 is an enlarged view of an alternative stem of the pump;

FIG. 4 is an enlarged view of the stem;

FIG. 4A is a cross-sectional view taken along line 4A-4A;

FIG. 5 is an elevational view of the pump with a deflectable diaphragm;

FIG. 6 is an enlarged view of the nozzle of the pump;

FIG. 7 is an elevational view of the portion of the shroud about the dispensing opening in the shroud;

FIG. 8 is a top view showing the locking and operating positions of the nozzle cap; and,

FIG. 9 is a plan view of the sealing members.

DETAILED DESCRIPTION OF THE INVENTION

Referring to the FIGS., a pre-compression pump 10 is shown, along with various features thereof. The pump 10 generally includes a body 12, and a nozzle cap 14.

The body 12 is formed with a generally tubular outer wall 16 with a transverse web 18 which divides the body 12 into two chambers, an upper chamber 20 and a lower chamber 22, and a web opening 24 communicates the two chambers 20 and 22.

The nozzle cap 14 is disposed in the upper chamber 20, whereas, the lower chamber 22 cooperates with a bottom wall 26 to define fluid reservoir 28. The bottom wall 26 may be detachable from the outer wall 16 so as to permit charging of fluid directly into the fluid reservoir 28.

A tubular cylinder 30 is mounted about the web opening 24 and extends into the fluid reservoir 28. As shown

in FIG. 1, a rubber washer 32 is disposed over, and presses against, the cylinder 30. A holding member 34, disposed to engage and hold the rubber washer 32, is preferably snap-fitted onto an annular ridge 36 protruding from the web 18. Also, vent holes 38 extend through the web 18. It is preferred that the vent holes 38 be out of contact with the rubber washer 32, so that air may be drawn through the web 18 and into the fluid reservoir 28 during use.

A tubular piston 40 is disposed within the cylinder 30 and extends therefrom through the rubber washer 32 and into the upper chamber 20. The rubber washer 32 is generally circumferentially in contact with, and forms a seal about, the piston 40. In addition, the piston 40 has an outer surface 42 which is in contact with the cylinder 30, due to an interference fit being defined therebetween. It must be noted however that the interference fit may not be excessive since the piston 40 must be slidable relative to the cylinder 30. In addition the nozzle cap 14 is mounted onto the piston 40 such that the two elements move together.

A cylindrical stem 44 is disposed within the cylinder 30 and partially telescoped within the piston 40. The stem 44 is slidable relative to both the cylinder 30 and the piston 40. Additionally, the stem 44 is urged into contact with the piston 40 by a return spring 46 disposed between the stem 44 and lower end 48 of the cylinder 30. The interaction of top edge 50 of the stem 44 and lip 52 of the piston 40 limits the upward movement of the stem 44.

A fluid passage 54 is defined in the piston 40 about the stem 44 and above the lip 52. The fluid passage 54 is in

fluid communication with passage 56 formed in the nozzle cap 14. The passage 56 has a bend 58 which re-directs the passage 56 to nozzle 60.

In operation, fluid F is disposed within the fluid reservoir 28. With the pump 10 being fully primed, the fluid F is also present within the cylinder 30. An inlet 62 is formed in the lower end 48 which communicates cylinder chamber 64, encompassed by the cylinder 30, and the fluid reservoir 28. An annular seal 66 is mounted within the cylinder chamber 64 so as to form a seal about the stem 44. Upon depressing the nozzle cap 14, the piston 40 is translated downwardly, pressing against the top edge 50 of the stem 44 and against the spring force of the return spring 46. As the piston 40 and the stem 44 move downwardly, the volume of the cylinder chamber 64 above the annular seal 66 decreases, thereby increasing the pressure of the fluid F trapped therein. The pressure of the fluid F acts on all surfaces in contact with the fluid F, including a tapered actuating surface 68. With further downward movement, the pressure of the fluid F increases to the point where the fluid F presses down on the actuating surface 68 so as to separate the top edge 50 of the stem from the lip 52 of the piston 40. The pressurized fluid F then escapes from the cylinder chamber 64 through the fluid passage 54, into the passage 56, and out of the nozzle 60. As the fluid F escapes, the internal pressure of the cylinder chamber 64 decays. The phenomenon of pressure fluctuations described above take effect with the fluid F being dispensed from the nozzle 60. With the pressure within the cylinder

chamber 64 being sufficiently decayed the stem 44 is urged into contact with the piston 40.

The stem 44 is formed with a plurality of longitudinally extending splines 70 which separate recesses 72. When pressurizing the cylinder chamber 64 during pumping, the splines 70 are located below the seal 66 with the annular seal 66 generally sealing a full circumference of the stem 44.

In this manner, no fluid F by-passes the seal 66. With the further decrease in pressure in the cylinder chamber 64, a pressure differential is created across the annular seal 66, the stem 44 is urged toward the piston 40, and the fluid F is drawn into the cylinder chamber 66 through the recesses 72 under the annular seal 66. Consequently, the pump 10 is re-charged, and ready for re-use.

The description above generally describes the operation of the pump 10. Below are various features which elaborate upon different aspects of the invention.

REDUCTION OF FLUID PULSING

Various features are provided to minimize pressure fluctuations, in repeated opening and closing of the pump 10 during operation, to avoid repeated engagement and disengagement of the top edge 50 of the stem 44 and the lip 52 of the piston 40. Accordingly, non-atomized microdoses of fluid may be delivered. First, the interference fit between the piston 40 and the cylinder 30 is reduced from that found in the prior art. Typically, the interference fit is approximately .010 inches. With the subject invention, the interference fit is approximately .005 inches. Accordingly, the return spring 46 can be formed with a weaker spring force

than that in the prior art, since less resistance is presented by the interference fit, and/or the return spring 46 can be wound to have a slower return velocity than that found in the prior art. In either regard, the weaker/slower response of the return spring 46 will retard the spring's response to pressure decay in the cylinder chamber 64. With the return spring 46 responding weakly/slowly, the stem 44 will not engage and disengage the piston 40 as repeatedly in the prior art.

In addition, as shown in FIG. 2, a portion of the passage 56, preferably the bend 58, is enlarged relative to other portions thereof. In this manner, the enlarged portions of the passage 56 reduce flow restriction, and, thus, reduce any potential throttling of the fluid F above the stem 44. In addition, the increased area serves as a pocket or cushion to smooth out pressure fluctuations.

Separately, also as shown in FIG. 2, a bumper 74 may be mounted to the top edge 50 of the stem 44. The bumper 74 is elastically deformable to respond to pressure applied thereto by the fluid F. The bumper 74 can be a hollow dome-shaped member which protrudes from the stem 44, or, alternatively, can be a solid pellet or ball which is partially inserted into the stem 44 and extends therefrom. The bumper 74 will absorb some of the pressure fluctuations in the fluid F and immunize the operation of the pump 10 thereagainst.

Referring again to FIG. 1, a ratchet tooth 76 may be formed on the piston 40 to bear against the stem 44. The ratchet tooth 76 is plate shaped with a generally triangular

profile. The bearing of the ratchet tooth 76 against the stem 44 creates friction which inhibits relative movement between the stem 44 and the piston 40. Again, the inhibition of movement of the stem 44 serves to limit the effect of pressure fluctuations. A plurality of ratchet teeth 76 may also be provided.

Furthermore, with reference to FIG. 3, the annular seal 66 may be formed with a generally right-triangular cross-section, having a pointed edge 78 for engaging the stem 44. With this structural arrangement, a generally planar lower surface 80 is defined which is generally perpendicular to the axis of the stem 44. This perpendicular arrangement creates more fluid drag during use against upward movement of the stem 44, thereby inhibiting the movement of the stem 44 and further reducing the effects of pressure fluctuations.

Typically in the pump art, a seal in a seal/shaft arrangement is sized so that the seal diameter is a little smaller than the shaft to ensure a good seal. Often, the seal is 0.010 inches smaller than a shaft diameter in seals typically used in hand-held pre-compression pumps, such as the annular seal 66. Referring to FIG. 4, a constant-diameter portion 82 is formed in the stem 44 above the splines 70 which may be 0.010 inches larger than the inner diameter of the annular seal 66. Alternatively, as shown in FIG. 3, the constant-diameter portion may be substituted for by conical portion 84. The conical portion 84 is preferably made with an upper diameter 86 slightly greater, e.g..002 inches, than the inner diameter of the annular seal 66. Also, preferably a lower diameter 87 is provided of .005 inches. The conical

portion 84 provides a progressively looser fit in the seal 66 as it progresses down through the seal 66 with the movement of the stem 44, thereby allowing the stem 44 to move downwards with less resistance from the seal 66 throughout the dispensing stroke. This reduction in resistance from the seal 66 reduces the creation of pulses.

PRIMING

The elimination of air pockets and bubbles, especially upon initial use of the pump 10 is critical to ensure proper priming is achieved, especially where microdoses are concerned.

Most prior art pump dispensers house fluid to be dispensed at the bottom of the dispenser; the dispenser then pulls, or lifts, the fluid upwards via a dip tube which dips into the liquid. In contrast, the pump 10 houses the fluid F around the cylinder 30 and does not utilize a dip tube. Instead, the inlet 62 is in direct communication with the fluid reservoir 28. As shown, the inlet 62 may be coextensive with the cylinder 30, or may be formed to extend slightly therefrom. Costs are saved by removing the dip tube component. Also, priming is enhanced, because the fluid F is disposed at a higher elevation with respect to the cylinder 30 as compared to the elevation of fluid in prior art pumps utilizing dip tubes. With the subject invention, the fluid F at least partially engulfs the stem 44 with the cylinder 30 substantially being coextensive with the fluid reservoir 28 and the inlet 62 being located in proximity to the bottom wall 26.

The recesses 72 allow air to leak freely out of the cylinder chamber 64 during priming. The splines 70 are relatively shallow, preferably 0.001 to 0.005 inches, which allows air to pass downwards with the pump 10 not in use. The annular seal 66 is disposed about the splines 70 with the pump 10 not in use. In addition, because of the shallowness of the splines 70, fluids will be generally too viscous to pass through the recesses 72, and, thus, will remain above the seal 66 in an unactuated state. In re-charging the cylinder chamber 64 after a dispensing operation, the fluid F is urged through the recesses 72 under force of the aforementioned pressure differential.

Additionally, as shown in FIG. 1, it is preferred that the inlet 62 be located off-center in the lower end 48 of the cylinder 30. Preferably, the inlet 62 will be located off-center in a direction away from the nozzle 60. Since the pump 10 will often be inclined slightly towards the nozzle 60 in use, the off-center location will encourage entrapped air to be expelled into the fluid reservoir 28, where it can rise freely up to the vent holes 38.

Furthermore, the inside surface 88 of the lower end 48 is preferably inclined, relative to the cylinder 30, so as to encourage the fluid F to spread evenly across the inside surface 88 upon entry. This ensures that pockets of air do not become trapped at this point.

As yet another additional feature, the pump 10 of the subject application can be provided with a deflectable diaphragm 90 for accelerating the priming operation. Currently, prior art pumps prime themselves prior to dosing

liquid by stroking up and down several times. Once fully flooded with liquid they then begin to dose. The problem with very low dose pumps (any below 70 micro-liters) is that the number of strokes required to prime can be high, simply because the internals of the pump are of relatively high volume compared to the dose volume of the pump. Referring to FIG. 5, the diaphragm 90 protrudes from the outer wall 16 prior to initial use of the pump 10. Instead of priming the dispenser by pressing the cap several times, the user presses the diaphragm 90, which deflects inwards into the fluid reservoir 28 and remains in that position. The indenting of the diaphragm 90 decreases the volume of the fluid reservoir 28, thereby raising the pressure in the fluid reservoir 28 which spontaneously drives the fluid F into the cylinder 30. In order for the fluid F to be driven into the cylinder 30, the stem/piston interaction of the top edge 50 and the lip 52, when in a dry condition, and allowing air in the pump 10 to pass therethrough. It should be noted that the rubber washer 22 should not leak at a lower pressure than the stem/piston interaction because the deflection of the diaphragm 90 would result in fluid leaking through the vent holes 38, without the pump 10 being actually primed.

SUFFICIENT OPERATING MOMENTUM

The basic operation described above is sufficient to dispense fluid out of the pump 10. But, if the pump 10 is operated very slowly, it is possible to dispense the fluid F so slowly that it dribbles down the outside of the nozzle 60 instead of leaping clear of the nozzle 60 as is desired for

reliable operation. U.S. Patent No. 5,881,956 describes a latch mechanism which is utilized to ensure a minimum amount of velocity is applied to actuate a pump. The pump 10 is also provided with a mechanical latch in the form of a plurality of fingers 92 which are cantilevered to, and extend downwards from, the stem 44. The fingers 92 bear against and slide freely against an upstanding pin 94 during downward movement of the stem 44 and the piston 40. In an unactuated state of the pump 10, it is preferred that the fingers 92 be located clear of and above the pin 94.

The pin 94 has a tapered end 96, with increasing diameters from smaller to larger. Preferably, the end 96 makes initial contact with the fingers 92 just prior to the point at which the upper end of the splines 70 on the stem 44 enter the seal 66 (which is the point at which the pump is about to dispense fluid).

The point at which the fingers 92 engage the tapered end 96 may be slightly in advance of the point at which the splines 70 enter the seal 66. To further advance the stem 44 downwardly, sufficient force must be applied to deflect the fingers 92 and cause yielding thereof. The increased downward force required to deflect the fingers 92 past the tapered end 96 provides sufficient momentum needed to ensure a minimum velocity is provided to the pump 10 to properly dispense a full dose of the fluid at an acceptable velocity.

CLEANLINESS

With respect to another aspect of the invention, to achieve reliable and safe dosing of fluid, the nozzle 60 and

free space around the nozzle cap 14 must remain clean and free from any accumulation of excess fluid, or the dried remnants of fluid.

Cleanliness of the nozzle 60 may be managed in several ways.

The portion of the outer wall 16 disposed about the upper chamber 20 defines a shroud 98 which shields the nozzle cap 14 and the nozzle 60 from dirt and debris. A dispensing opening 100 is defined in the shroud 98 which is located to register with the nozzle 60 during dispensing, so that dispensed fluid may pass through the shroud 98. When the pump 10 is not in use, and is in a rest position, the nozzle 60 is positioned behind a portion of the shroud 98. The nozzle 60 is disposed to be relatively close to a snout 102 formed about the opening 100. The snout 102 is used to aim the pump 10 when in use. The nozzle 60 is brought close enough to the snout 102 so that any liquid meniscus M which might remain on the nozzle 60 after dosing is wiped against the snout 102. As shown in dashed lines in FIG. 6, the meniscus M overlaps with portions of the snout 102. The wiping action has the tendency to transfer some of the excess fluid onto, or adjacent to, the shroud 102, thus reducing the height of the meniscus M. It is preferred that the liquid be transferred to the snout 102, rather than to other portions of the pump 10.

When the pump 10 is not in use, the nozzle cap 14 is rotated, preferably by about 40 degrees, into a locking position to prevent inadvertent operation. During this locking operation, any slight meniscus of liquid which might have gathered will not be wiped around the inside of the

shroud 102 which surrounds the cap 14 because of the prior wiping action against the inside of the snout 102.

A further embellishment to encourage liquid to transfer from the nozzle 60 to the snout 102 is provided by a series of angled cuts 104 on the inside face 101 of the snout 102. These cuts 104 are angled such that tapered lands 106 are defined which accommodate the excess liquid on the snout 102. The lands 106 diverge and becomes broader, and as the cap 14 is rotated to a lock position, the nozzle 60 wipes past the broadening region of a land 106. The broadening land 106 ends to pull the liquid outwards to its boundaries, defined by the cuts 104, which draw more liquid away from the nozzle 60 as the cap 14 is rotated to the locked position. Also, the cuts 104 act to break surface tension of the meniscus M, as the meniscus M is passed thereover.

Given that the inside of the snout 102 wipes the meniscus M on the nozzle 60, some of the excess liquid may partly transfer onto the snout 102, but can also be pushed downwards from the mouth of the nozzle 60 and roll over and down the outside of the protruding nozzle. A void 108 is provided around the nozzle 60 where any excess liquid can be transferred. In this way, the excess fluid can dry without interfering with the mouth of the nozzle 60.

To further encourage any meniscus M to roll over and onto the outside conical section of the nozzle 60 and be deposited within the void 108 defined about the nozzle 60, the front edge of the nozzle is rounded with a full radius, of typically 0.005 inches. This small radius tends to reduce any

meniscus formation by encouraging the rolling over mechanism to occur.

As a further embellishment to all the features mentioned above regarding meniscus elimination, all the surfaces which are designed to receive excess liquid from the nozzle 60 can be roughened during manufacture, on the basis that roughened surfaces will more readily attract liquid.

As previously mentioned the cap 14 is rotated relative to the body 12 of the pump 10 in order to lock it against unintended operation. To facilitate rotation, grooves 110 are cut into the outside of the cap 14 to provide a grip to provide for this rotation. The pump 10 provides for the outer surfaces of these grooves 110 to be roughened to improve the quality of the grip.

The rear part of the cap has flat faces 112 which can also be used to rotate the cap 14 into and out of its locked position. Pushing on one of the faces 112 will rotate the cap to lock, while pushing on the other face 112 will rotate the cap to unlock.

A pair of slotted faces 114 cut into the outside diameter of the cap 14 work in conjunction with a pair of protrusions 116 on the inside diameter of the shroud 98 to define the position at which the cap is permitted to descend and also the extremes of rotational travel of the cap 14. A detent 118 is added to each of the protrusions 116 within the shroud 98 which is formed to snap into a groove 118 when the cap 14 is rotated into the lock position. The detents 118 indicate that the lock position has been achieved by holding the cap 14 in that position. Similar shaped grooves 120 are

formed to correspond to the operating position of the cap 14, thus providing clear indications as to the locked and operating positions.

Once the locked position is achieved it is desirable to provide an intimate seal between the periphery of the cap 14 adjacent to the nozzle 60 and the inside of the shroud 98.

This is achieved by introducing three bands 122 of reduced diameter on the inside of the shroud 98, preferably equi-spaced, and three bands 124 of increased diameter on the cap 14, also preferably equi-spaced. One of the bands 124 on the cap 14 is preferably centered upon the nozzle 60. The diameters of the inside bands on the shroud 122 and outside bands 124 on the cap 14 are approximately equal in diameter, to provide a seal when overlapped. It is preferred that the overlapping occur when the pump 10 is locked, with the bands of the cap 124 being in pressing engagement with the bands of the shroud 122, preferably with transition fits. When the pump 10 unlocked and the cap 14 is urged into an operating position, the diameter bands on the shroud 122 and the cap 124 are spaced apart to allow unrestricted downward operation of the cap 14.

HANDLE

Since the fluid reservoir 28 is generally coextensive with the cylinder 30, the overall length of the pump 10 is relatively short. Accordingly, a handle H is provided for convenient handling and gripping. The handle H both provides an ergonomic grip for the user and also serves

to buffer the fluid reservoir 28. Preferably, the pump 10 will be filled in an inverted position, and the handle H will be snapped into place. The pump 10 will then be inverted to the normal upright position for further manufacturing operations.

The discussion set forth above is with respect to a pre-compression pump. Those skilled in the art will understand that the disclosure herein is exemplary and the inventive features may be applied to other types of pumps.

The invention is not intended to be limited to the embodiments discussed herein, but only limited by the scope of the appended claims.

WHAT IS CLAIMED IS:

1. A pump for dispensing fluid, said pump comprising:
a pump body having a pump cylinder and a fluid reservoir for accommodating the fluid, an inlet being formed in said pump cylinder in communication with said pump reservoir;
and a nozzle.
2. A pump as in claim 1, wherein said pump cylinder is disposed within, and extends substantially coextensively with, said fluid reservoir.
3. A pump as in claim 2, wherein said inlet is located in proximity to a wall of said fluid reservoir.
4. A pump as in claim 1, wherein said inlet solely defines a passage for said fluid between said fluid reservoir and said pump cylinder.
5. A pump as in claim 4, wherein said inlet is coextensive with said pump cylinder.
6. A pump as in claim 4, wherein said inlet protrudes slightly from said pump cylinder.
7. A pump as in claim 1, wherein said pump cylinder has a tubular body with a cylindrical wall, a generally open first end, and a generally closed second end, said inlet being formed in said second end, and wherein said second end having an inner surface facing said first end, said inner surface being obliquely disposed relative to said cylindrical wall.
8. A pump as in claim 7, said inlet being formed off-center in said second end so as to be located further from said nozzle than the center of said second end.
9. A pump as in claim 8, wherein said inlet is located gravitationally below said center point.

10. A pump as in claim 1, wherein said pump cylinder has a tubular body with a cylindrical wall, a generally open first end, and a generally closed second end, said inlet being formed in said second end, and wherein said inlet being formed off-center in said second end so as to be located closer to certain portions of said cylindrical wall than other portions of said cylindrical wall.

11. A pump for dispensing fluid, said pump comprising:
a pump body;

an elongated stem slidably disposed in said pump body,
said stem having a plurality of cantilevered fingers extending therefrom; and,

a pin disposed in said pump body, wherein said pin is located to be contacted by said fingers upon a predetermined extent of sliding movement of said stem, said fingers flexing upon contacting said pin such that said pin yieldingly inhibits movement of said stem, whereby a predetermined amount of force is required to overcome the inhibition of movement of said stem so as to enable operation of the pump.

12. A pump as in claim 11, wherein said fingers are circumferentially spaced about an end of said stem.

13. A pump as in claim 12, wherein said fingers are evenly spaced.

14. A pump as in claim 11, wherein said pin has a tapered end which is initially contacted by said fingers.

15. A pump as in claim 11, wherein said pin has a constant-diameter portion.

16. A pump as in claim 11, wherein said fingers are disposed to contact said pin and flexing outwardly upon yielding.

17. A pump as in claim 16, wherein said fingers are inherently biased to press against said pin after yielding.

18. A pump for dispensing fluid, said pump comprising:

a pump body;

an elongated stem slidably disposed in said pump body;

and,

a seal immovably mounted relative to said stem, wherein said stem being slidably, and at least partially sealably, disposed in said seal;

wherein, said stem is formed with spaced-apart longitudinally extending splines with recesses being defined between said splines, said splines defining an outer diameter which sealingly engages said seal.

19. A pump as in claim 18, wherein said recesses are relatively shallow.

20. A pump as in claim 18, wherein said stem has a constant-diameter portion extending from said splines.

21. A pump as in claim 18, wherein said stem has a conical portion extending from said splines.

22. A pump for dispensing fluid, said pump comprising:

a pump body;

a piston slidably disposed with said pump body;

a stem slidably disposed within said piston; and,

a return spring disposed to urge said stem towards said piston, wherein said stem separates from said piston in dispensing the fluid.

23. A pump as in claim 22, wherein said return spring is formed with a relatively weak spring force so that said stem is separated relatively easily from said piston.

24. A pump as in claim 22, wherein said return spring is wound to have a reduced return velocity.

25. A pump comprising:

a nozzle;

a pre-compression pump means for pumping fluid; and,

a passage communicating said pump means and said nozzle, said passage having cross-sectionally enlarged portions.

26. A pump as in claim 25, wherein said passage has at least one bend, said bend being cross-sectionally enlarged compared to portions of said passage adjacent to said bend.

27. A pump for dispensing fluid, said pump comprising:

a pump body;

a nozzle;

a stem slidably disposed in said pump body, said stem slidable in directions generally to and away from said nozzle; and,

a bumper disposed between said stem and said nozzle.

28. A pump as in claim 27, wherein said bumper is mounted to said stem.

29. A pump as in claim 28, wherein said bumper is an elastically-deformable dome-shaped member mounted onto an end of said stem.

30. A pump as in claim 28, wherein said bumper is an elastically-deformable member at least partially extending from an end of said stem.

31. A pump for dispensing fluid, said pump comprising:
a pump body;
a piston slidably disposed in said pump body;
a stem slidably disposed in said piston; and,
at least one ratchet tooth disposed on said piston, said
ratchet tooth bearing against said stem.

32. A pump as in claim 31, wherein said ratchet tooth is
generally plate-shaped.

33. A pump as in claim 31, wherein said ratchet tooth
has a generally triangular profile with an edge of said
ratchet tooth bearing against said stem.

34. A pump as in claim 31, wherein said ratchet tooth
bears against said stem continuously.

35. A pump for dispensing fluid, said pump comprising:
a pump body;
a nozzle cap operatively mounted to said pump body, a
nozzle being disposed in said nozzle cap; and,
a shroud rigidly fixed to said pump body, said shroud
having an opening formed therethrough for registering with
said nozzle during activation so as to allow an amount of
dispensed fluid to pass through said shroud from said nozzle,
wherein said nozzle moves relative to said shroud during
operation, and wherein a portion of said shroud being disposed
in proximity to said nozzle such that any meniscus of the
fluid formed on said nozzle after dispensing is at least
partially wiped by said opening with said nozzle moving
relative thereto.

36. A pump as in claim 35, wherein portions of said shroud disposed about said opening and facing said nozzle cap are roughened.

37. A pump for dispensing fluid, said pump comprising:
a pump body;

a nozzle cap operatively mounted to said pump body, a nozzle being disposed in said nozzle cap; and,

a shroud rigidly fixed to said pump body, said shroud having an opening formed therethrough for registering with said nozzle during operation so as to allow an amount of dispensed fluid to pass through said shroud from said nozzle, wherein a plurality of cuts are formed in said shroud about said opening, said cuts being spaced-apart so that a plurality of lands are formed about said opening.

38. A pump as in claim 37, wherein said cuts radiate from said opening.

39. A pump as in claim 38, wherein said cuts taper apart in radiating from said opening.

40. A pump as in claim 37, wherein said lands are roughened.

41. A pump for dispensing fluid, said pump comprising:
a pump body;

a nozzle cap operatively mounted to said pump body, a nozzle being disposed in said nozzle cap; and,

a shroud rigidly fixed to said pump body, said shroud having an opening formed therethrough for registering with said nozzle during operation so as to allow an amount of dispensed fluid to pass through said shroud from said nozzle,

said shroud partially encompassing an empty void defined externally of said nozzle cap and about said nozzle.

42. A pump as in claim 41, wherein said nozzle protrudes from said nozzle cap so as to define a free end spaced from said nozzle cap.

43. A pump as in claim 42, wherein said free end of said nozzle is rounded.

44. A pump as in claim 43, wherein said free end is rounded with a radius of .005 inches.

45. A pump as in claim 42, wherein said free end is roughened.

46. A pump for dispensing fluid, said pump comprising:
a pump body;
a nozzle cap operatively mounted to said pump body, a nozzle being disposed in said nozzle cap; and,
a shroud rigidly fixed to said pump body, said shroud having an opening formed therethrough for registering with said nozzle during operation so as to allow an amount of dispensed fluid to pass through said shroud from said nozzle, wherein said nozzle cap is rotatable relative to said shroud, at least one detent being formed on one of said shroud and said nozzle cap, at least one groove being formed to receive in seating engagement said detent, and wherein said groove is positioned to receive said detent in seating engagement with said nozzle being rotated away from said opening into a locked position.

47. A pump as in claim 46, wherein at least two pairs of detents and grooves are provided.

48. A pump as in claim 46, wherein said nozzle cap is formed with a solid portion in registration with each of said detents in said locked position, the registration of said detents and said solid portions preventing activation of said nozzle cap.

49. A pump for dispensing fluid, said pump comprising:
a pump body having a wholly contained fluid reservoir;
and,

a tubular handle extending from said pump body.

50. A pump as in claim 49, wherein said handle has a closed end.

51. A pump for dispensing fluid, said pump comprising:
a pump body;
a fluid reservoir formed in said pump body; and,
a deflectable diaphragm mounted in a wall of said pump body, said diaphragm being deflectable into said fluid reservoir so as to decrease the volume encompassed by said fluid reservoir.

52. A pump for dispensing fluid, said pump comprising:
a pump body;
a nozzle cap operatively mounted to said pump body, a nozzle being disposed in said nozzle cap; and

a shroud rigidly fixed to said pump body, said shroud having an opening formed therethrough for registering with said nozzle during operation so as to allow an amount of dispensed fluid to pass through said shroud from said nozzle, wherein said nozzle cap is rotatable relative to said shroud, wherein said nozzle cap being formed with at least one radially extending sealing member, said shroud being formed with at least one inwardly extending shroud sealing member,

said sealing members being located to overlap with said nozzle cap being rotated to a pre-determined position relative to said shroud.

53. A pump as in any preceding claim, wherein said pump is a pre-compression pump.

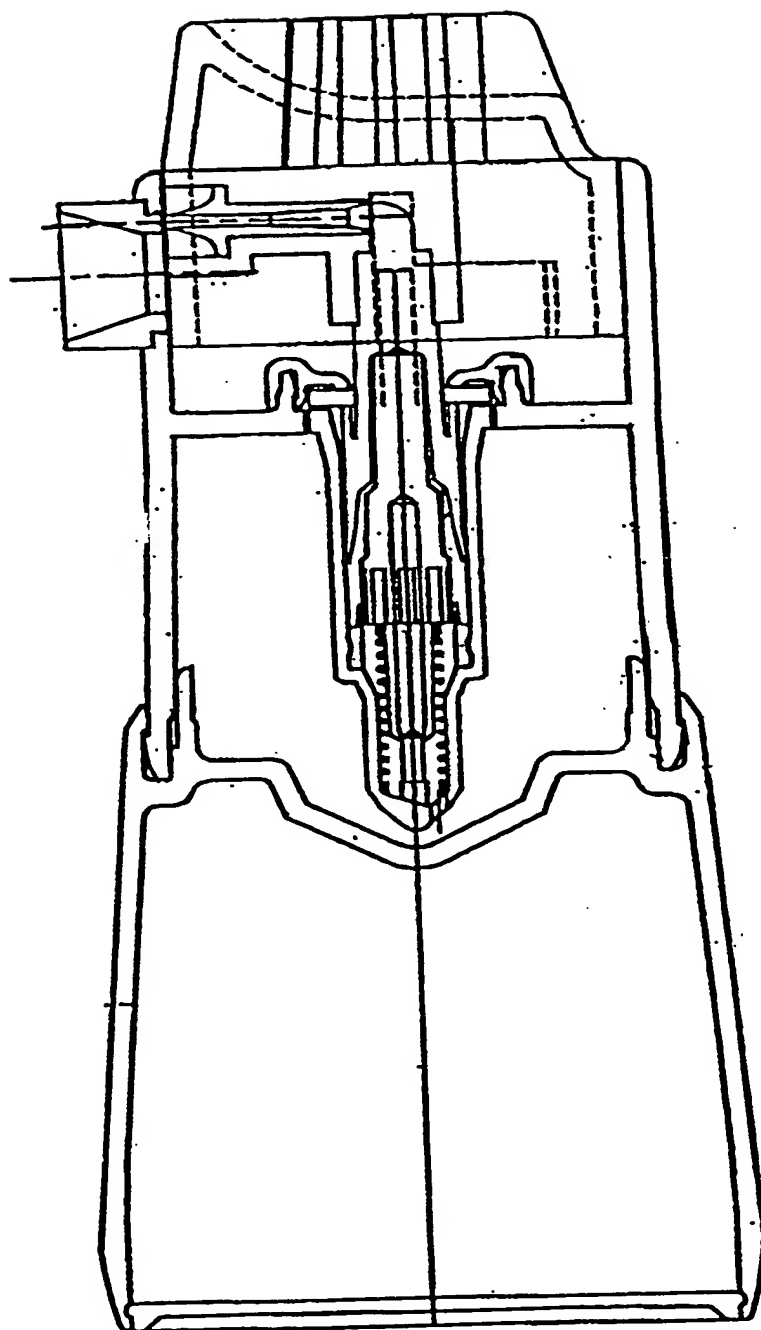


FIG. 1

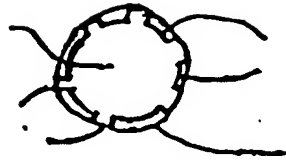


FIG. 1A

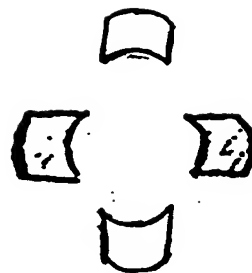


FIG. 4A

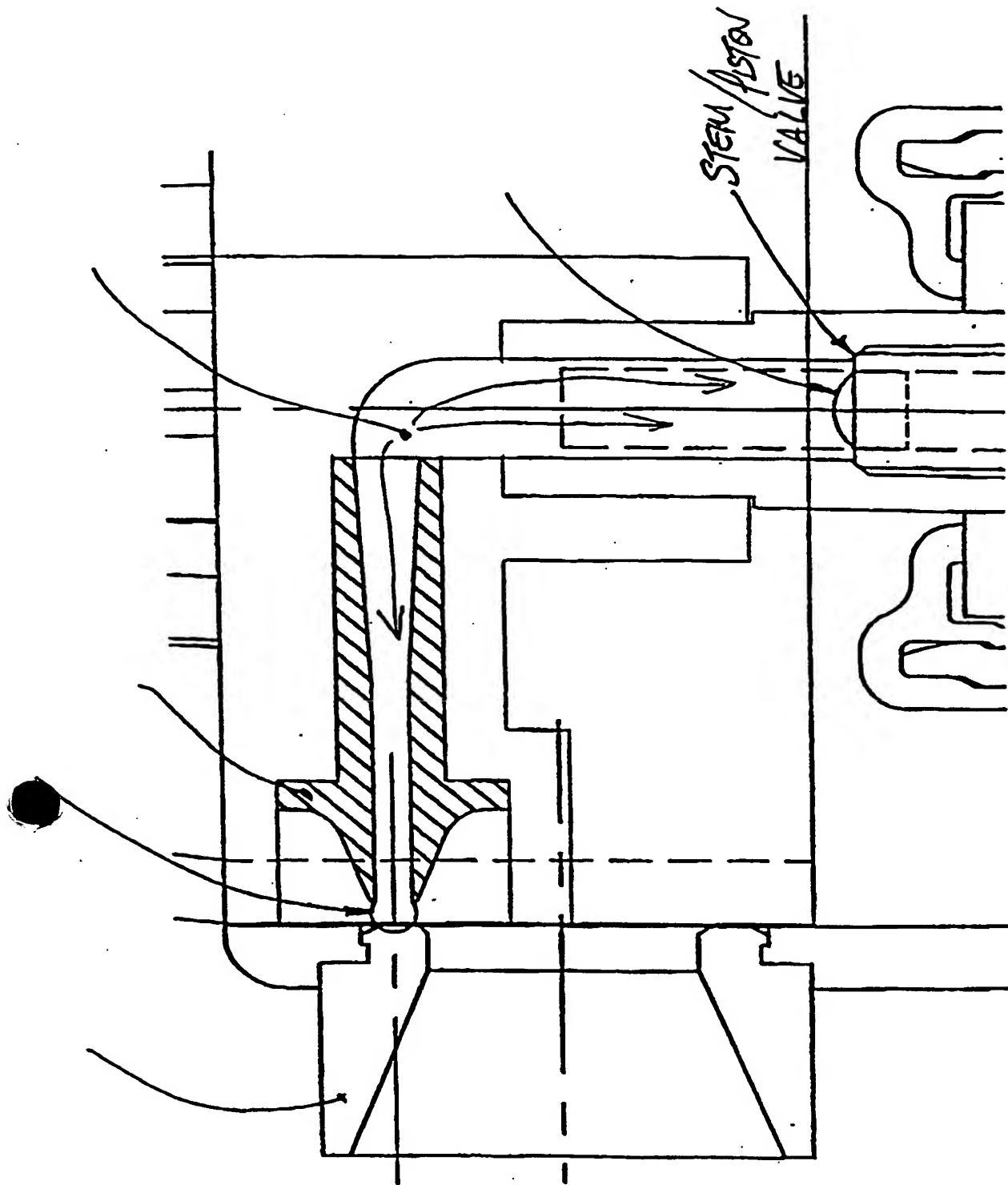


FIG. 2

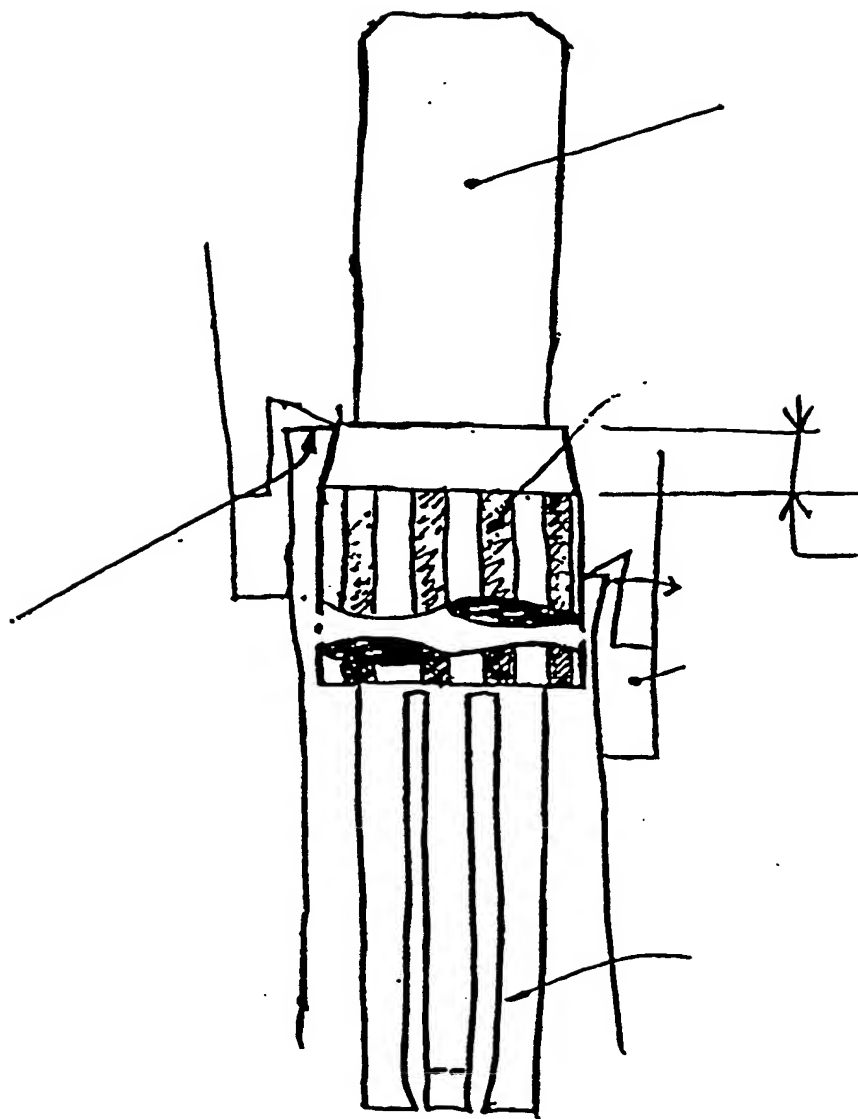


FIG. 3

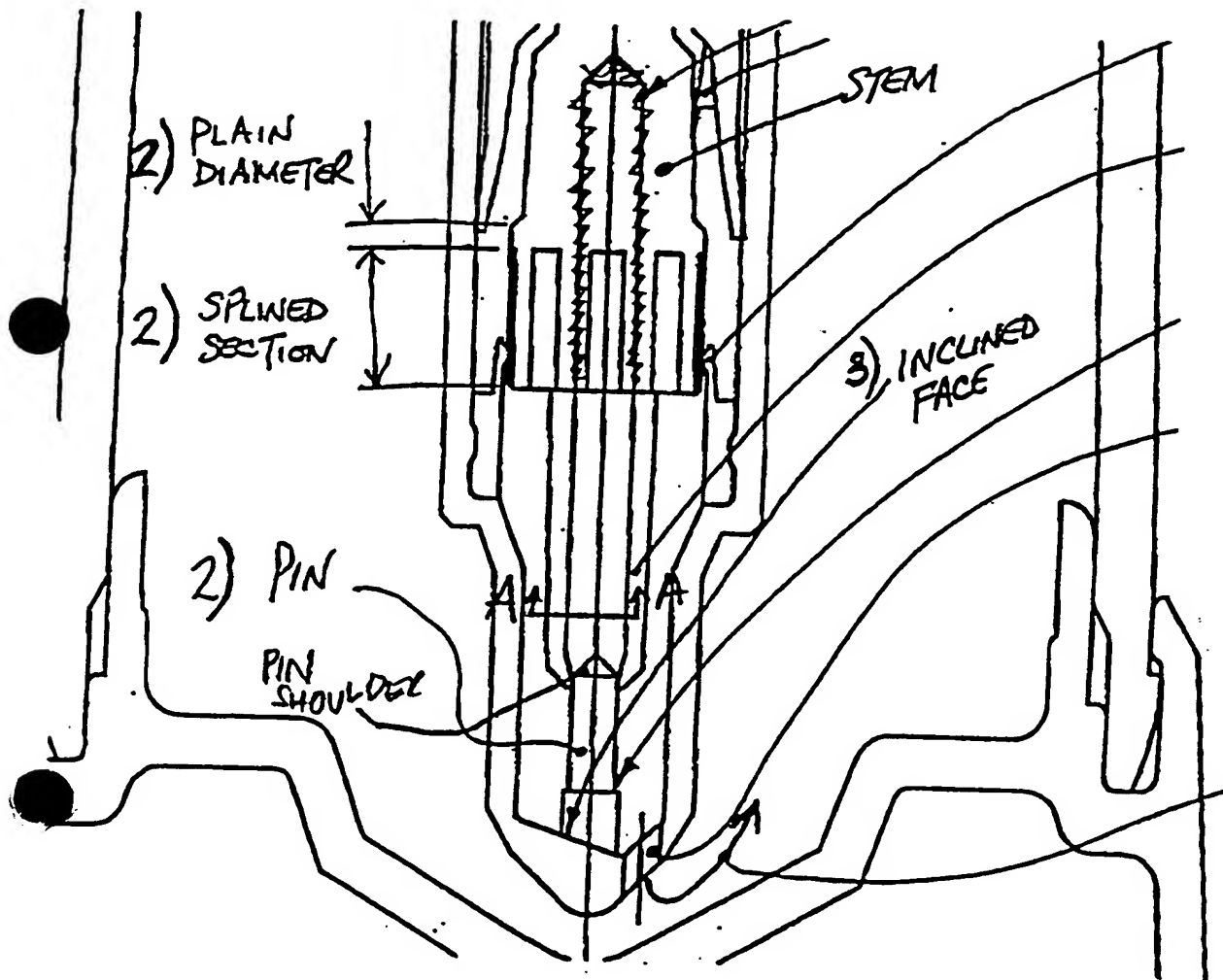


FIG. 4

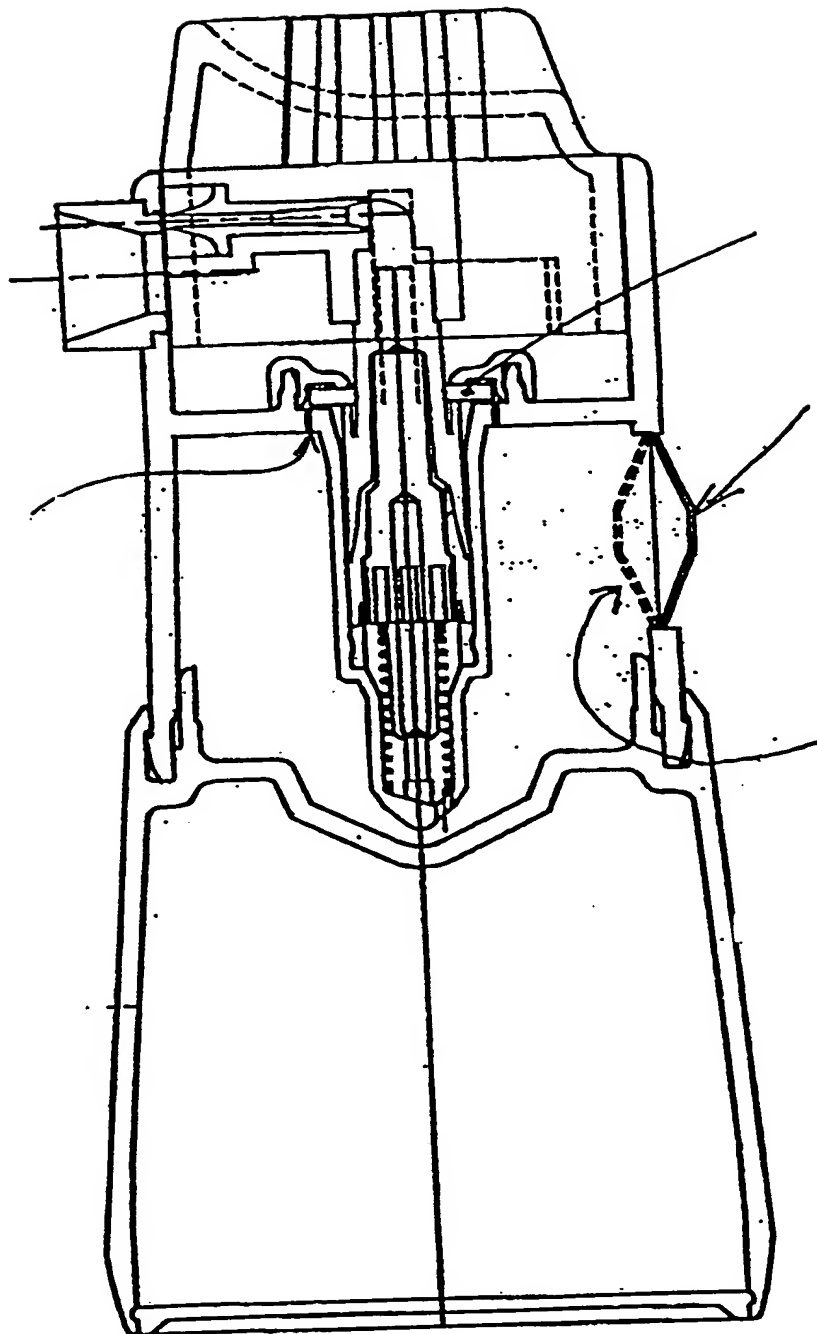
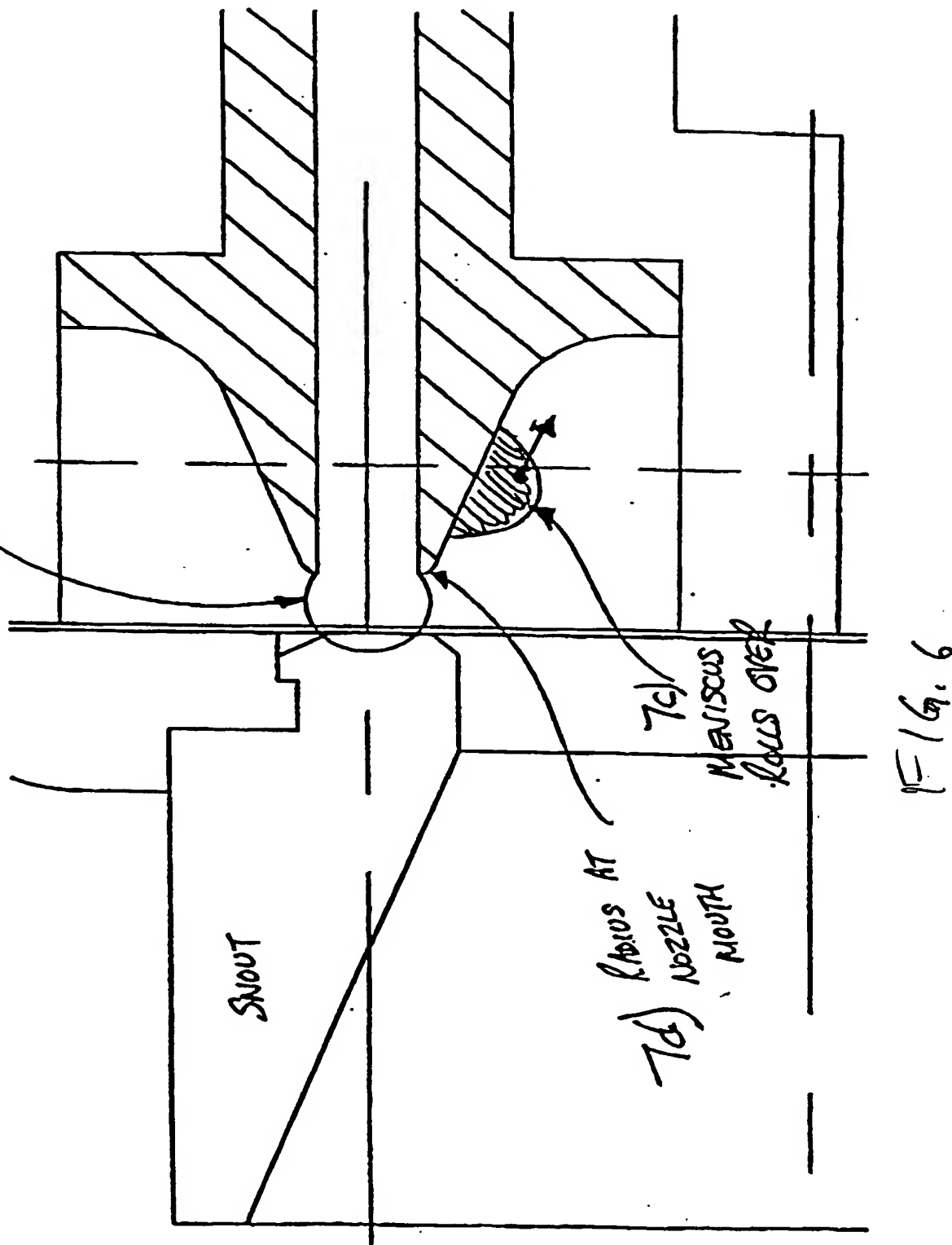


FIG. 5



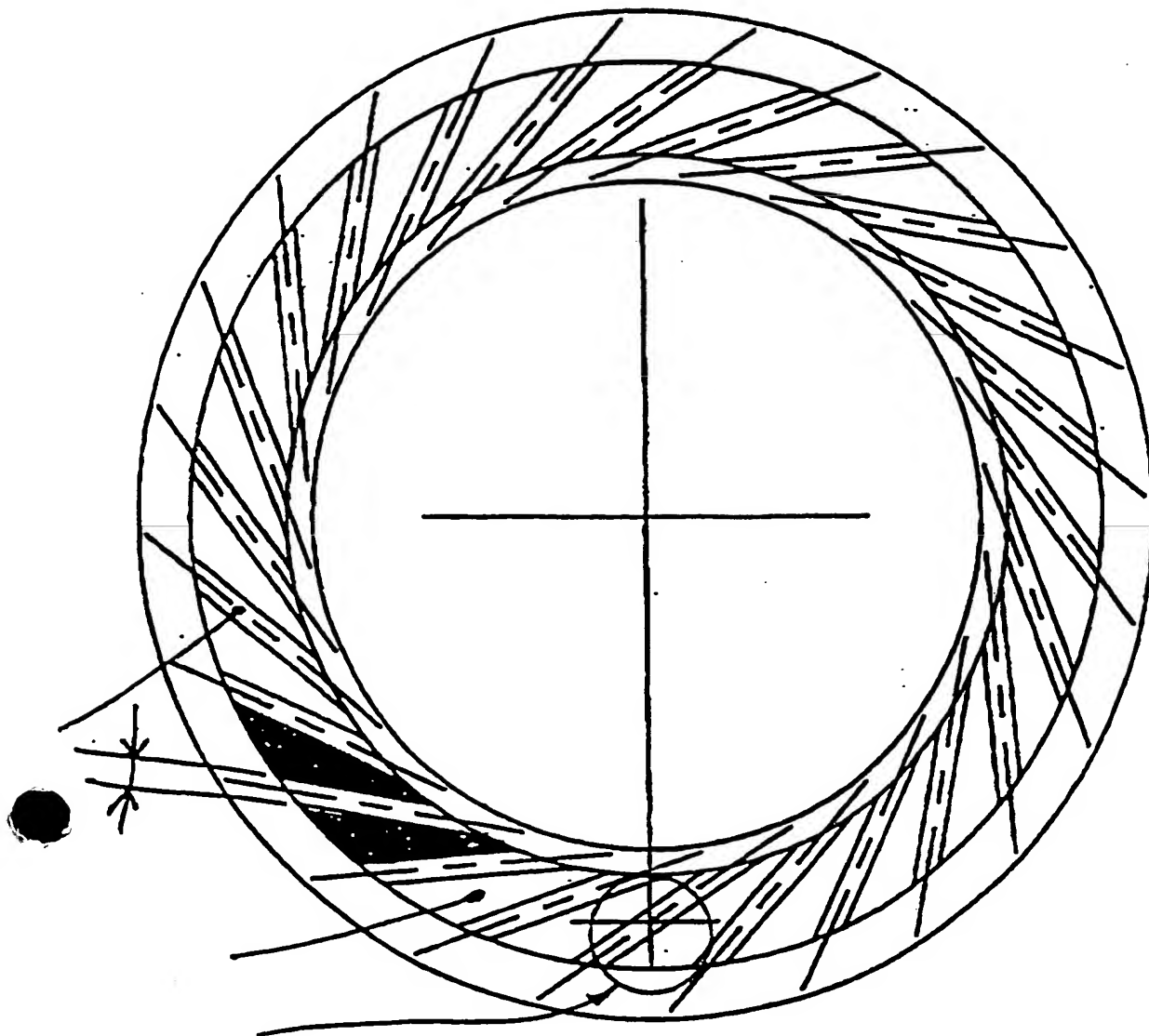


FIG. 7

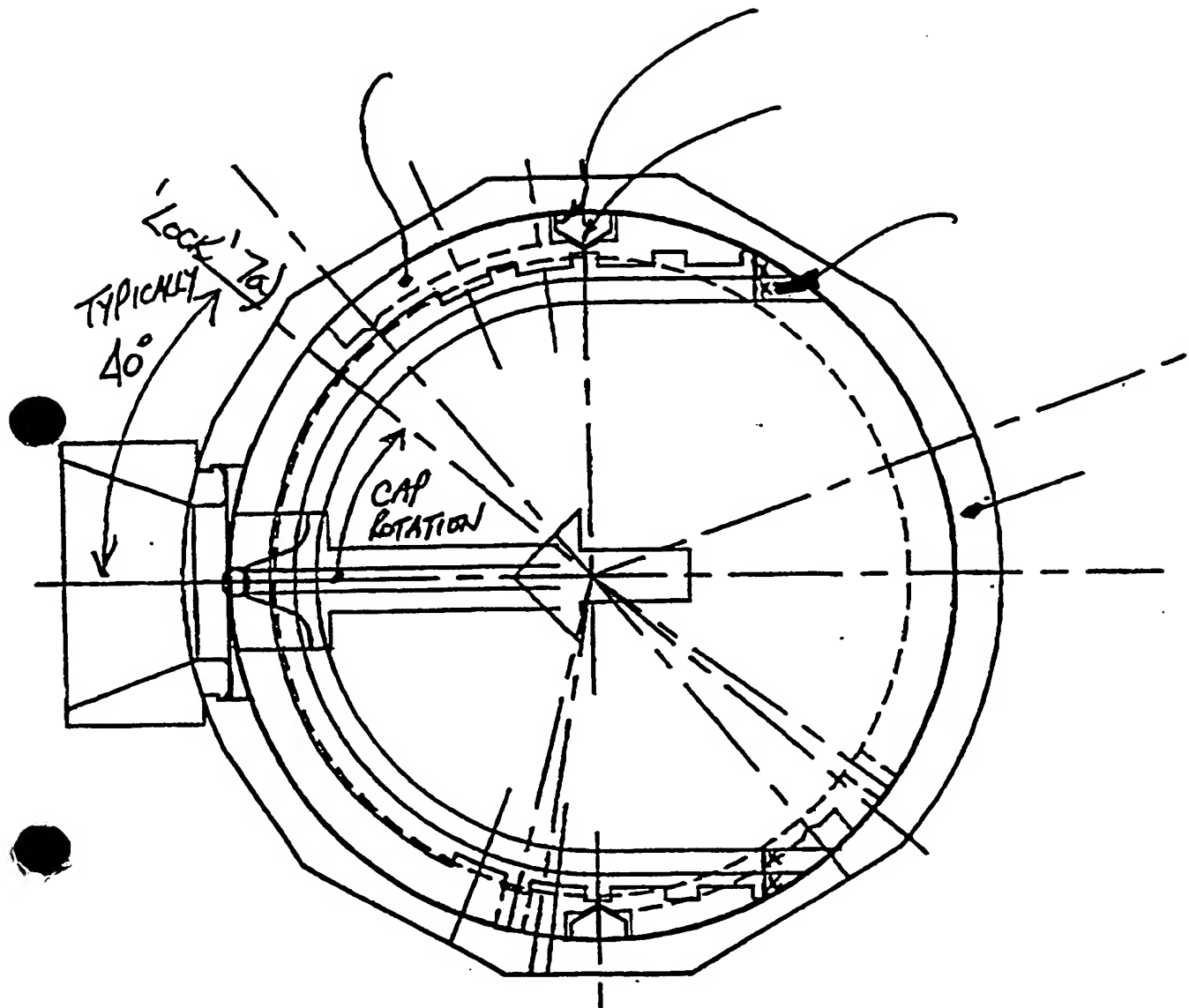


FIG. 8

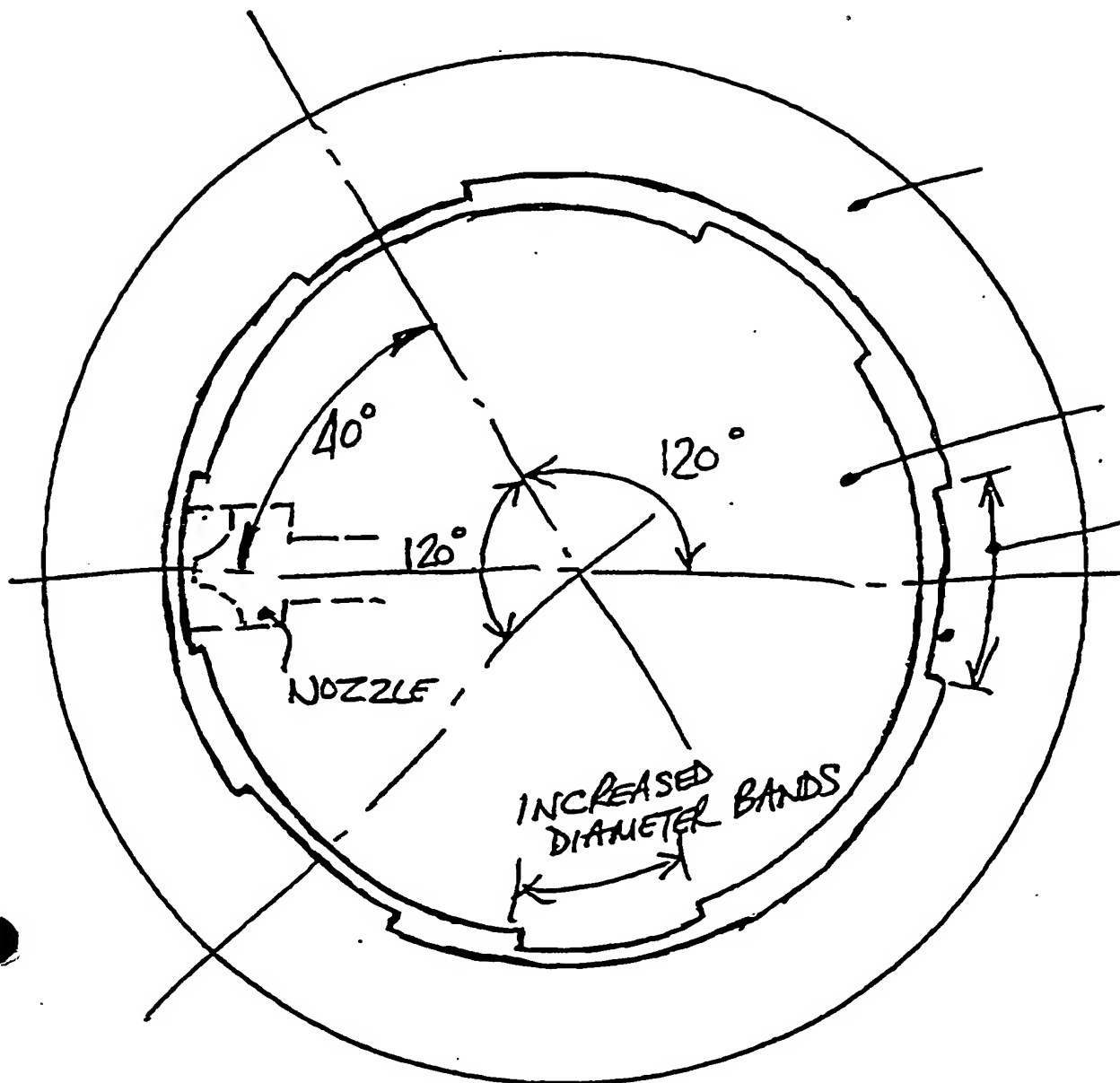


FIG. 9

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US00/23206

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) :B67D 5/42

US CL :222/321.5, 321.9, 382

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 222/321.5, 321.9, 382

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 3,352,463 A (BERLER) 14 NOVEMBER 1967, col. 2, line 10 to col. 5, line 10.	1-5
X	US 5,806,721 A (TADA) 15 SEPTEMBER 1998, col. 4, line 9 to col. 9, line 2.	1-4, 6
X	US 5,381,932 A (HUMPHREY) 17 JANUARY 1995, col. 2, line 44 to col. 3, line 61.	1-4, 6-7
A	US 5,062,549 A (SMITH et al.) 05 NOVEMBER 1991, Fig. 3.	NONE
A, T, E	US 6,126,038 A (OLEGNOWICZ) 03 OCTOBER 2000, Fig. 1.	NONE



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:	*T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
A document defining the general state of the art which is not considered to be of particular relevance	*X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
E earlier document published on or after the international filing date	*Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
I document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	*a* document member of the same patent family
O document referring to an oral disclosure, use, exhibition or other means	
P document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search

09 NOVEMBER 2000

Date of mailing of the international search report

28 NOV 2000

Name and mailing address of the ISA/US
Commissioner of Patents and Trademarks
Box PCT
Washington, D.C. 20231

Facsimile No. (703) 305-3230

Authorized officer

KENNETH BOMBERG *Diane Smith*

Telephone No. (703) 308-2179

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US00/23206

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This international report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

Please See Extra Sheet.

- ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:
1-10

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US00/23206

BOX II. OBSERVATIONS WHERE UNITY OF INVENTION WAS LACKING

This ISA found multiple inventions as follows:

This application contains the following inventions or groups of inventions which are not so linked as to form a single inventive concept under PCT Rule 13.1. In order for all inventions to be searched, the appropriate additional search fees must be paid.

Group I, claim(s) 1-10 & 53, drawn to a pump including an inlet in communication with a reservoir.

Group II, claim(s) 11-17 & 53, drawn to a pump with a plurality of cantilevered fingers and a pin.

Group III, claim(s) 18-21 & 53, drawn to a pump with a seal mounted to a stem.

Group IV, claim(s) 22-24 & 53, drawn to a pump including a spring urging a stem toward a piston.

Group V, claim(s) 25-26 & 53, drawn to a pump with a passage with an enlarged cross section portion.

Group VI, claim(s) 27-30 & 53, drawn to a pump with a bumper between a stem and a nozzle.

Group VII, claim(s) 31-34 & 53, drawn to a pump including a ratchet tooth on a piston bearing against a stem.

Group VIII, claim(s) 35-36 & 53, drawn to a pump with a shroud with an opening registering with a and wiping a nozzle.

Group IX, claim(s) 37-40 & 53, drawn to a pump with a shroud with a plurality of cuts.

Group X, claim(s) 41-45, drawn to a pump including a shroud encompassing a void.

Group XI, claim(s) 46-48 & 53, drawn to a pump with a shroud having a relatively rotatable nozzle.

Group XII, claim(s) 49-50 & 53, drawn to a pump with a tubular handle.

Group XIII, claim(s) 51 & 53, drawn to a pump with a deflectable diaphragm.

Group XIV, claim(s) 52 & 53, drawn to a pump with nozzle cap formed with a radially extending seal member.

The inventions listed as Groups I-XIV do not relate to a single inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons: In each of the Groups listed above, the identified special technical feature has been omitted from the independent claims of each of the other Groups listed above.